

Citation:

Galgani JE, Uauy RD, Aguirre CA, Díaz EO. Effect of the dietary fat quality on insulin sensitivity. *Br J Nutr*. 2008 ;100(3):471-9.

PubMed ID: [18394213](#)

Study Design:

Systematic Review

Class:

M - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

This review aims to analyse human studies that address the effect of dietary fat quality on insulin sensitivity.

Inclusion Criteria:

Fatty acid quality as unique independent variable.

Dietary compliance at least fairly controlled.

Well-powered studies (at least sixteen subjects in each group or intervention period), with a crossover design and inclusion of washout period; providing evidence of good or excellent dietary compliance, body weight stability and control for menstruation cycle as appropriate.

Glucose disposal rate corrected for hepatic glucose production was considered as additional strength in studies in type 2 diabetic subjects.

Insulin sensitivity assessed using reference methods.

Exclusion Criteria:

Unreliable measures of insulin sensitivity.

Sample size less than 16 subjects

Studies that did not monitor achievement of target fat intake.

Description of Study Protocol:**Recruitment**

A literature search in PubMed for randomized clinical trials in human subjects published until 31 August 2007 was conducted. These articles were identified with the following key words: fatty acid type and insulin. Other articles not identified after this first search were found using the Related Articles option available in Medline. Bibliographies of primary references were used to identify additional relevant studies.

Design: Systematic review. The review analyzed human studies where the effects of dietary fat quality on insulin sensitivity. Special attention was given to the methodological aspects of each study.

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis: Strength and weakness analysis in supplementary material.

Data Collection Summary:

Timing of Measurements

A literature search until Aug 31 2007 was conducted on the effect of fatty acids on insulin sensitivity.

Dependent Variables

- Insulin sensitivity

Independent Variables

- Fatty acids and dietary fat quality

Control Variables

Description of Actual Data Sample:

Initial N: 41 studies

Attrition (final N): 9 trials in nondiabetic subjects (N = 358); 6 trials in subjects with type 2 diabetes (N = 93)

Age: Not reported

Ethnicity: Not reported

Other relevant demographics: Not reported

Anthropometrics Not reported

Location: International studies

Summary of Results:

Key Findings

- From the total number of identified studies (n = 41), fifteen matched the proposed quality criteria.
- Three out of the fifteen studies reported a differential effect on IS, showing decreased insulin sensitivity after SFA v. MUFA or PUFA diets; whereas increased insulin resistance after fish oil supplementation was observed in type 2 diabetic individuals.
- Most studies (twelve of fifteen) found no effect relating to fat quality on insulin sensitivity. However, multiple study design flaws limit the validity of this conclusion. In contrast, one of the better designed studies found that consumption of a high-saturated-fat diet decreased insulin sensitivity in comparison to a

high-monounsaturated- fat diet.

- Vessby et al. study reported a significant decrease in insulin sensitivity of 10% after consuming a SFA-enriched diet for 12 weeks, whereas no change in insulin sensitivity was observed with the MUFA-enriched diet.
- Fish oil v. olive oil supplementation were additionally compared in this study; however, no differential effect on insulin sensitivity was found.
- Increased TLR-4-mediated cytokine generation was observed after SFA (palmitic acid), but not n-3 PUFA supplementation.
- Significant differences in insulin sensitivity between SFA and MUFA diets were found; however fish oil supplementation did not modify insulin sensitivity.
- The combination of increased muscle TAG and palmitate content were the main determinants of impaired insulin sensitivity. These studies suggest that dietary fat quality may be a relevant factor in pathogenesis of insulin resistance (impaired insulin sensitivity) and type 2 diabetes.
- Results from controlled and intervention studies permit a more specific assessment of the effect of fatty acid quality on insulin sensitivity
- The potential protective effect of n-3 PUFA on IS in human subjects might require higher fish-oil doses associated with lower n-6 PUFA content. Studies in a healthy and diabetic population using diets with low absolute amounts of n-6 PUFA should be preferred in order to adequately test the potential effect of fish oil on IS.
- Fat sources such as linseed oil, which are rich in α-linolenic acid (.55% of total FA) can be used to reduce amount of n-6 FA with the aim to achieve a dietary n-6 : n-3 PUFA ratio lower than 4:1 but as close to 1:1 as possible.
- The fatty acids should no longer be considered solely as a source of energy but should rather be acknowledged as potent regulators of intermediary metabolism, and possible contributors to the regulation of glucose homeostasis in both type 2 diabetic and non-diabetic individuals.

Author Conclusion:

We conclude that the role of dietary fat quality on insulin sensitivity in human subjects should be further studied, using experimental designs that address the limitations of existing data sets.

Reviewer Comments:

More information is required with regard to the population, demographic details and the relative risk of diabetes in relation to the fatty acids.

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

- | | | |
|----|---|-----|
| 1. | Will the answer if true, have a direct bearing on the health of patients? | Yes |
| 2. | Is the outcome or topic something that patients/clients/population groups would care about? | Yes |
| 3. | Is the problem addressed in the review one that is relevant to nutrition or dietetics practice? | Yes |
| 4. | Will the information, if true, require a change in practice? | Yes |

Validity Questions

1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described?	Yes
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes
4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issues considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes
8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	Yes

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